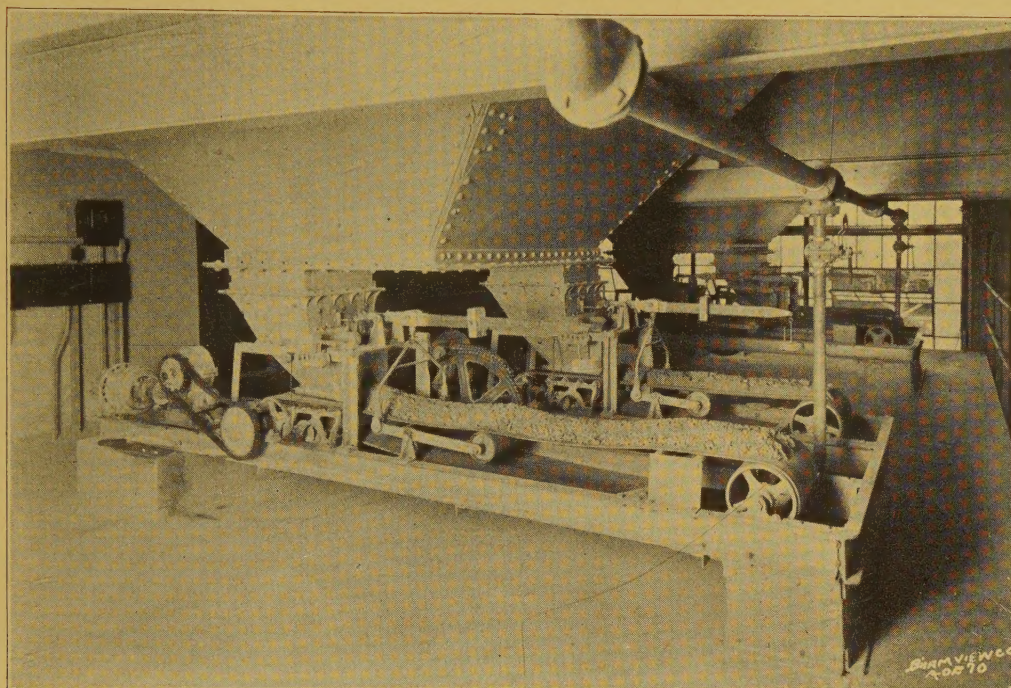


MILL SECTION of
Concrete

Schaffer Poidometers



Photograph showing four of eight Poidometers proportioning raw and finish materials and feeding same to compeb mills at one of the leading Southern cement plants

For Feeding Your Compeb Mills

A POIDOMETER driven by a D. C. variable speed motor is the most practical FEEDER obtainable.

It will deliver the material to the mills **by weight** and not volume, thus assuring you of a uniform feed at all times.

Whenever it is necessary to change the feed to the mill, all that the operator will have to do is to turn the rheostat, which will change the speed of the Poidometer Belt.

The Productimeter which is part of the POIDOMETER will enable the operator to ascertain just what amount of material each mill is grinding in a given unit of time.

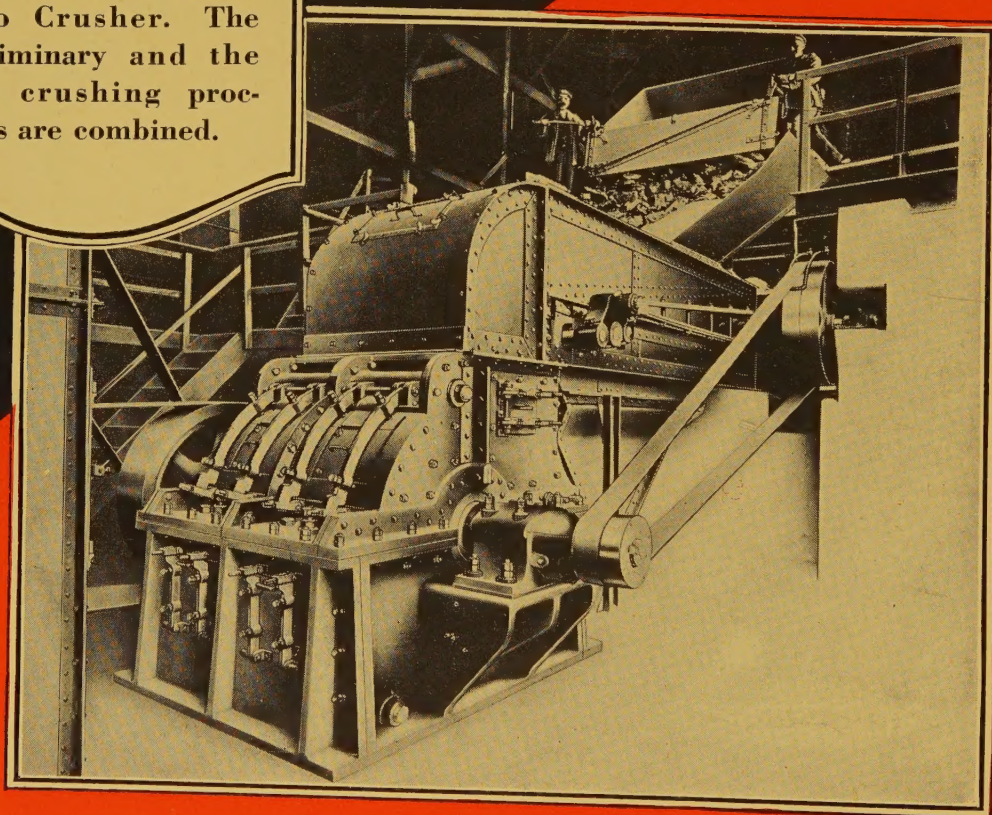
LET US BUILD PROFIT FOR YOU
Engineering Advice and Catalog on Request

SCHAFER POIDOMETER COMPANY
 2828 Smallman Street Pittsburgh, Pennsylvania

POLYSIUS

SOLO CRUSHERS

THE Famous SOLO principle, that of one operation doing the work ordinarily requiring two, is embodied in the Polysius Solo Crusher. The preliminary and the fine crushing processes are combined.



POLYSIUS CORPORATION
BETHLEHEM TRUST BLDG.
BETHLEHEM, PA.

MILL SECTION of Concrete

The Cement Mill Edition of Concrete is edited exclusively for those interested in the manufacture of cement. Its pages are devoted to discussions of plant design, management, operation, production efficiency, chemical research and control, quarry operation, progress and news of the industry.

The Cement Mill Edition also contains all the material published in the corresponding Regular Edition and so provides news of the uses and merchandising of the materials whose manufacture is discussed in the Mill Edition. The Regular Section furnishes mill operating officials and mill executives valuable points of contact with the users of the materials they produce.

Volume 32

April, 1928

Number 4

CONTENTS

□ □ □

"New England's Own and Only Cement Plant" Nears Completion—(Illus.) 101

Northern location influences the design of the new mill of the Lawrence Portland Cement Company at Thomaston, Maine, from the standpoint of winter operation.

Work on Seattle Plant Begins 110

A preliminary description of the new plant of the Pacific Coast Company at Seattle, Wash., now under construction.

The Color of Cement 111

A discussion of some of the factors, such as iron content, oxidation of clinker, clinker cooling, extent of calcination, fine grinding, etc., that affect the color of cement.

The Development of the Alumina Cement Industry 113

This is part III of M. Blanc's study of special

cements in Europe, and presents an interesting review of the development and manufacture of fused aluminous cements, both in Europe and America.

Editorial 115

Quality of Cement Discussed

Men and Mills—(Illus.) 116

Several pages of news about cement plants and the men who operate them.

Cement Statistics for February—(Illus.) 120

REGULAR SECTION

Better Concrete Was Theme of American Concrete Institute Sessions 13

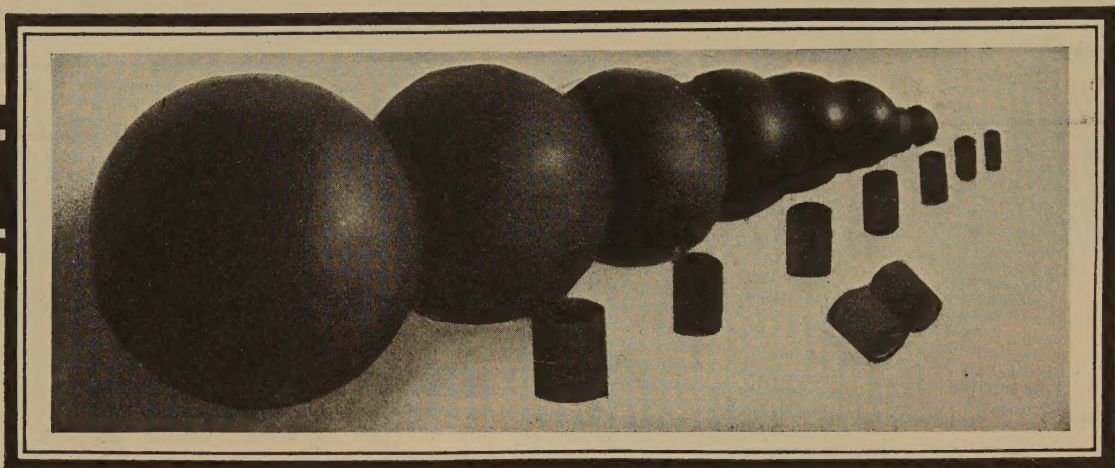
Cement manufacturers will find much of interest to them in the report of the American Concrete Institute Convention in Philadelphia.

Copyright, 1928, Concrete Publishing Company

INDEX TO ADVERTISEMENTS

Allis-Chalmers Mfg. Co. 129	Haynes Stellite Co. 128	Meade, Richard K., & Co. 136
American Manganese Steel Co. 121	Heine Boiler Co., The 119	Pennsylvania Crusher Co. 132
Babcock & Wilcox Co. 127	Hunt, Robert W., Co. 94	Polysius Corp. 98
Baker & Spencer, Inc. 136	Huron Industries, Inc. 123	Quigley Furnace Specialties Co., Inc. 137
Bates Valve Bag Corp. 126	International-Combustion-Engr. Co. 119	Sargent, E. H., & Co. 132
Bradley Pulverizer Co. 134	Jeffrey Mfg. Co. 124	Schaffer Poidometer Co. 97
Burrell Engineering & Const. Co. 135	Jones Foundry & Machine Co. 130	Smidth, F. L., Co. 138
Coates Steel Products Co. 100	Keystone Driller Co. 135	Sonntag, C. H. 136
Edge Moor Iron Co. 122	Kritzer Co., The 136	Standard Oil Co. 133
Engineering & Designing 138	Latimer, Robert L., & Co. 137	Super Cement Co., The 96
Foster Wheeler Corp. 136	Link-Belt Co. 131	Timken Roller Bearing Co., The 12
Fuller Co., The 125		

COATES GRINDING MEDIA



INSURE GRINDING EFFICIENCY

We manufacture nothing but grinding media. All our time and thought is given to the question of how to make our one product the best that it can possibly be. As a result we have developed a line of grinding bodies that we believe are unexcelled anywhere, cost and service considered.

We offer to cement manufacturers, two distinct types of grinding bodies, each having certain peculiar advantages. These two types are:

"TUNGSCO" STEEL NUGGETS CARBEX FORGED STEEL BALLS

If you will let us know what your grinding requirements are, we shall be glad to submit you prices on grinding media of such type, grade and sizes as may be best suited to your work. We carry ample stocks and can make prompt shipment of any grade or size.

Coates Steel Products Company
GREENVILLE, ILLINOIS

Largest Exclusive Manufacturers of Grinding Media

Index to Advertisers on Page 99 of This Section

Concrete

Vol. 32

Chicago, April, 1928

No. 4

"New England's Own and Only Cement Plant" Nears Completion

New Mill of the Lawrence Portland Cement Company at Thomaston, Maine, Will Get into Production for the 1928 Construction Season—Northern Location Influences the Design of the Plant from the Standpoint of Winter Operation—Interesting Type of Material Storage Building Erected—Selection of Site Result of Careful Study—Water, Rail and Highway Transportation Facilities Provided—Description of Equipment Installed—Layout of Plant

CONSTRUCTION of the new plant of the Lawrence Portland Cement Company started early in May, 1927, when 200 men began to prepare the site near the coast to receive the plant buildings which early this year will become an active cement plant with a capacity for manufacturing 1,000,000 barrels of cement annually. The plant will get into operation some time during April.

An item of particular interest to cement mill operators in the erection of this plant is the design of the plant from the standpoint of winter operation. Because of the severe climate and possibility that for some years the shipments will be limited during the winter season, inside and protected storage for stone and clay was provided of sufficient capacity to permit three months' operation without the necessity of working either the quarry or the clay pit. Outside storage for coal is also provided on the same basis and clinker grinding equipment was installed of sufficient capacity to permit clinker to be stored during the winter months so it can be ground faster than it is produced during the shipping season. These provisions permit the shutting down of practically all outside work during the most severe part of the winter.

Two separate materials storage buildings were erected—one for clay, the other for rock, clinker and gypsum. Some interesting design features, which will be described later, were incorporated in the side walls of both the main and the clay storage building.

Location and Transportation Facilities

The mill is located adjacent to the Atlantic highway, Maine's principal north and south coastal route, between the cities of Thomaston and Rockland. These two cities are approximately four miles apart, the mill being about a mile from Thomaston. Rockland has a population of about 8,000, while Thomaston has approximately 2,000.

An electric railway operating between the two cities provides passenger transportation to the plant.

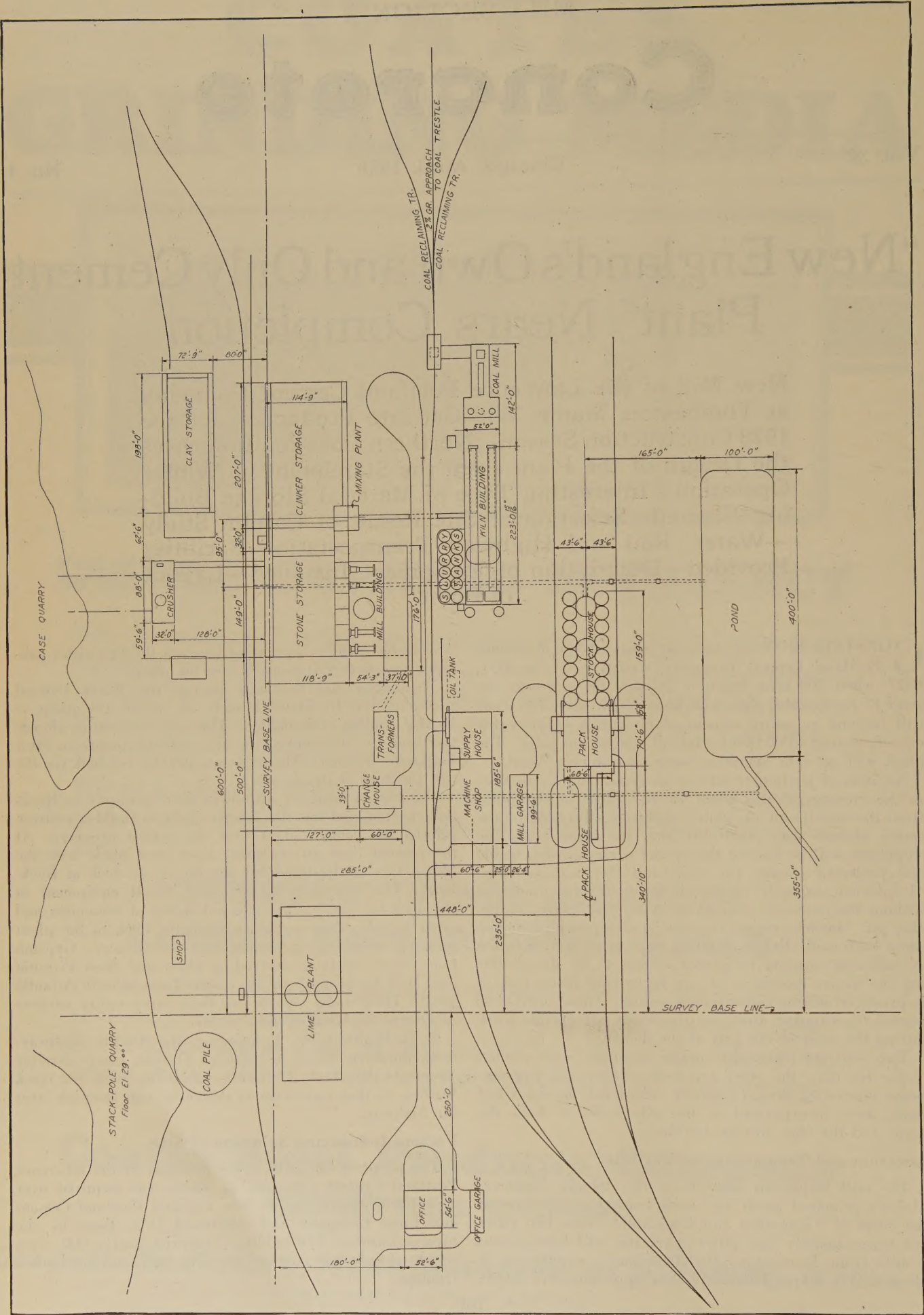
Thomaston and Rockland are on the Maine Central Railroad, the Rockland branch, on which the plant is located, ending at Rockland. This rail connection affords facilities for distribution to all southern points in New England. Northern Maine points can be reached via the rail junction at Brunswick.

The cement company also owns shore property on Rockland harbor and has the charter right to build a railway joining the cement plant with the harbor property. At the present time arrangements have been made with the Maine Central Railroad for the use of its dock at Rockland. The cement company will install equipment at the dock for the loading and unloading of schooners and other vessels. Cars are taken from the dock to the plant under a switching agreement with the railway. Gypsum from Nova Scotia is received by water and West Virginia coal will be brought in by vessels from middle Atlantic ports. These same vessels can then carry return cargoes of cement to Atlantic coast cities.

U. S. Highway No. 1, known as the Atlantic highway, from northern Maine to southern Florida, passes directly alongside the plant. Provisions are being made for truck loading so that some cement deliveries can be made over the highway.

Factors Influencing Selection of Site

The property comprising the holdings of the Lawrence Portland Cement Company in Maine was acquired over a period of years, by the New England Portland Cement and Lime Company and purchased from them by the present owners. The holdings comprise nearly 900 acres which include quarry, clay deposits, mill site and harbor frontage.



Layout of the new Lawrence Portland Cement Company plant at Thomaston, Maine

The largest tract consists of the quarry and clay land, about three miles from the harbor property. Either location could be used as the mill site.

Before construction was started, a very careful analysis was made to determine the relative advantages of these two available sites. The costs of transferring the raw materials to the harbor and of transporting the coal and cement between plant and dock were studied. It was found that it would be more economical to build the mill near the raw materials and this fixed the location of the plant.

Limestone Supply

Limestone is found in a number of New England locations but nowhere was clay found close enough to the limestone for economical cement manufacturing except in the vicinity of Thomaston.

The limestones of the Rockland-Rockport region have been known and used for nearly a century and a half. Lime burnt from this stone has been distributed in sailing vessels all down the coast, even to the cities along the Gulf of Mexico.

Geologically, the deposits are very ancient. They belong to the late Cambrian system. They are very much folded; their original structure is lost and their fossils are obliterated. This extreme folding has made quarrying operations unusual, since in many instances the strata stand practically on edge. As a result, the quarries that have been worked here for many years are deep, narrow pits, up to 300 feet in depth and more than 1000 feet long, while their widths are not more than 150 to 200 feet. Usually the walls on each side of these quarries were composed of stone not suitable for lime burning and new materials had to be taken from the bottom.

The quarrying methods used indicate that the analysis of the stone varies rapidly as the deposit is crossed transversely. It has been found that those portions of the quarry containing rock that has been rejected for lime burning are in practically all cases suitable for making cement. In fact, some of the material has analyses closely approaching those of the cement rock found in the Lehigh Valley.

Clay Supply

Two sources of clay are available for use in connection with the limestone.

One of these is the glacial deposit on top of the limestone. All this region was intensely glaciated. The surface of the limestone has been planed off and shows some striking examples of glacial grooving.

This glacially deposited clay is somewhat spotty in character and portions of it are too sandy or too gravelly for use in cement manufacture. Since it forms a layer of from 3 to 6 feet in depth over the limestone and must be removed in order to recover the stone, it is proposed to use as much of it as is of the composition desired.

The other source of clay is from fillings in the valleys of the streams draining into Penobscot Bay. These clays are marine formations deposited in the valleys at a time when the surface of the ocean was approximately 150 feet higher than it now is. It represents the residue of the degradation of the then existing land surface.

All geological evidence indicates that the relative levels of land and ocean have varied considerably in past ages. The valleys now filled with clay are erosion channels cut out by the streams in this higher land. This portion of Maine is known to geologists as a "drowned coast."

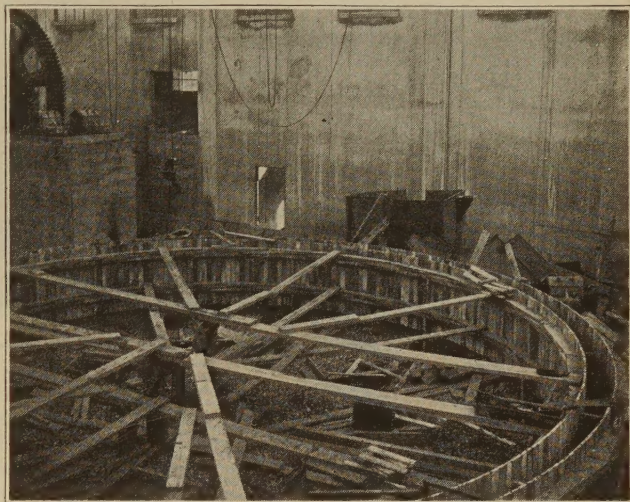
The Clay Stream

Clay is excavated by a Thew crawler type gasoline loco-

motive crane operating a 1 cubic yard dragline Page bucket. It is dumped directly into 6-yard Western 2-way dump cars, operating on a standard gauge track. An 8-ton Vulcan locomotive transports the clay train to an elevated track from which the clay is dumped directly into one side of the enclosed clay storage building.

The clay storage building is a concrete structure, 175 feet long by 60 feet wide by 55 feet high. It is served by a Harnischfeger overhead, electric traveling crane, carrying a 3 cubic yard Hayward bucket. This crane operates along the length of the building, distributing the clay in storage and delivering it into the hopper feeding an American Clay Machinery Company granulator.

The granulator discharges by gravity into a pair of stone separating rolls, also supplied by the American Clay Machinery Company. Still moving by gravity, the clay enters an Allis-Chalmers 26-foot wash mill.



Construction of the clay basin in the mill room

Wilfley pumps now transport the clay "slip" from the wash mill to a circular storage basin, 30 feet in diameter by 22 feet deep, fitted with a Minogue agitator. From here it is pumped to two Allis-Chalmers Ferris wheel feeders, one for each grinding mill. The feeders are operated under the control of the plant chemists who proportion the materials at this point before the combined clay and rock stream enter the grinding mills.

The Rock Stream

Rock at the quarry is picked up by a model 37 Marion electric shovel, with full Ward-Leonard control, in a 1¾-yard dipper and placed into 10-yard Phoenix type dump cars, supplied by the Easton Car and Construction Company. When the quarry is extended so as to require it, an 8-ton Vulcan locomotive will be used to transport the stone to the bottom of the quarry incline.

Loaded rock cars are pulled up this twin incline to the crusher house, located at the edge of the quarry. An Allis-Chalmers hoist with a 9-foot drum and a 250 h.p. motor operate the cars up the inclines. There are two inclined tracks and the hoist operates the cars over them in balance—one car going up while the other is descending. This arrangement effects a saving of 40 per cent of the power that would be required to operate each incline separately.

Arriving in the crusher house, the rock cars are dumped by means of a Shepard electric hoist, discharging their contents into a 42-inch gyratory Allis-Chalmers crusher which reduces the rock to 6-inch size. The throw of this

A portion of the quarry, showing the type of quarry operation previously followed



crusher has been reduced and the size of the head increased, so that it will crush to a smaller size at a sacrifice of output. In spite of this change, the capacity of the crusher is still greater than is required for normal operation of the plant.

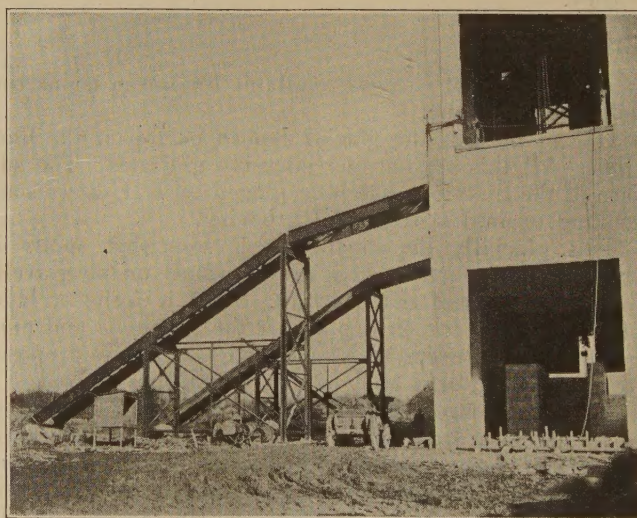
A Chain Belt pan conveyor takes the rock from the primary crusher to a Williams "Jumbo" hammer mill, operated by a 300 h.p. motor. The discharge from the hammer mill is picked up by a Robbins inclined belt conveyor, 30 inches wide, which, in turn, discharges onto a similar conveyor built into the side wall of the rock storage. An automatic traveling tripper discharges the belt uniformly along its length into the section of the storage building reserved for rock.

The rock storage space is a part of the main storage building in which sections are also provided for gypsum and clinker, as shown in the accompanying plant layout. The storage building is served by a 100-foot span Har-

nischfeger electric overhead traveling crane, operating a 3-yard Hayward bucket. This crane distributes the rock and delivers it to the mill feed bins, the discharge of which joins the clay stream as previously described, before entering the grinding mills.

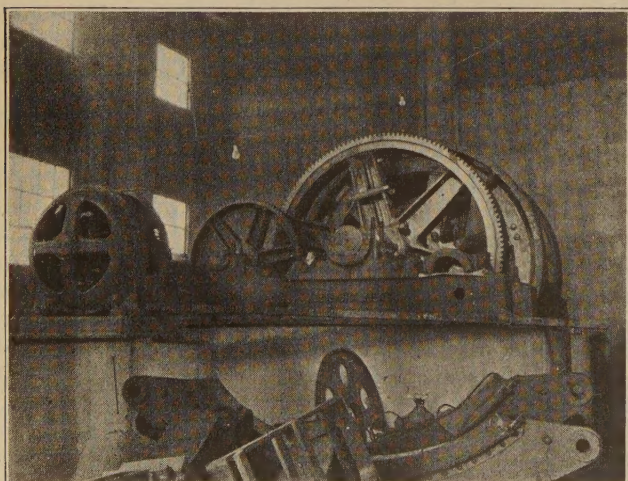
Storage Building Design

The design of the side walls of the main and clay storage buildings is of particular interest. These walls are

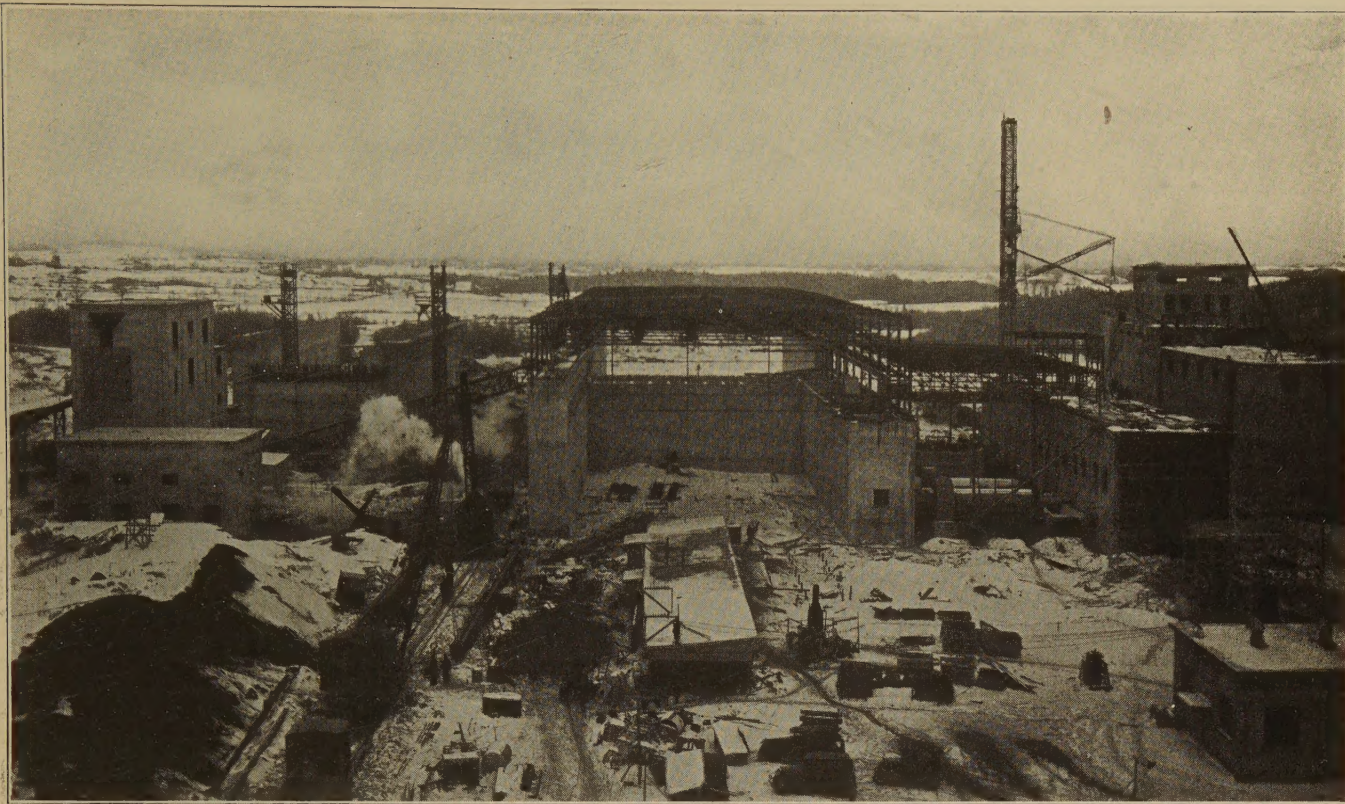


The twin inclines for rock, built at the edge of the quarry and leading to the crusher house

essentially retaining walls, yet they must also carry the heavy moving loads of the overhead cranes. They are 55 feet high. In order to avoid the cumbersome and expensive stationary forms that would be necessary if the walls were built as conventional retaining walls, a special cellular wall was designed. This wall consists primarily of two



The quarry hoist on its foundation



General view, showing the main storage building in the center, the clay storage in the right background and the mill room adjacent to the main storage

thin longitudinal walls joined by transverse partitions. Because this design permitted the use of uniform sections throughout its height, it could be built economically with slip forms.

Stability is obtained by filling the hollow spaces in the wall with clay or earth of the required density. The

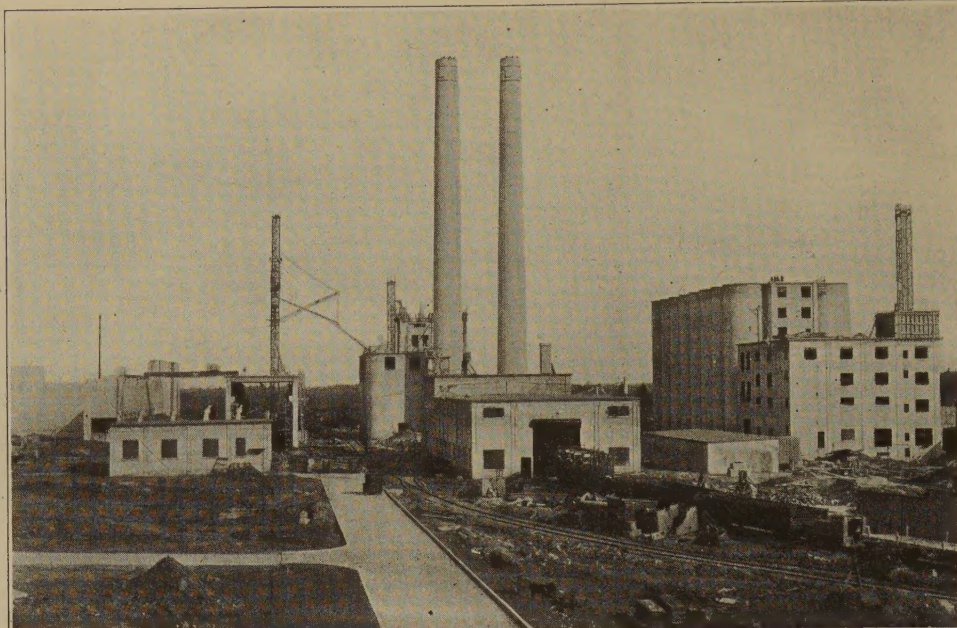
walls are carried on reinforced concrete slabs which rest on a series of large, circular, reinforced concrete columns carried to solid rock.

This design also permitted the placing of the rock conveyor inside the side wall of the main storage building as previously described.



A view of the grinding department before the roof was placed and before clay storage basin was built between compeb mills

The plant nearing completion. To the right are the storage silos and pack-house. The low building at the left is the change house



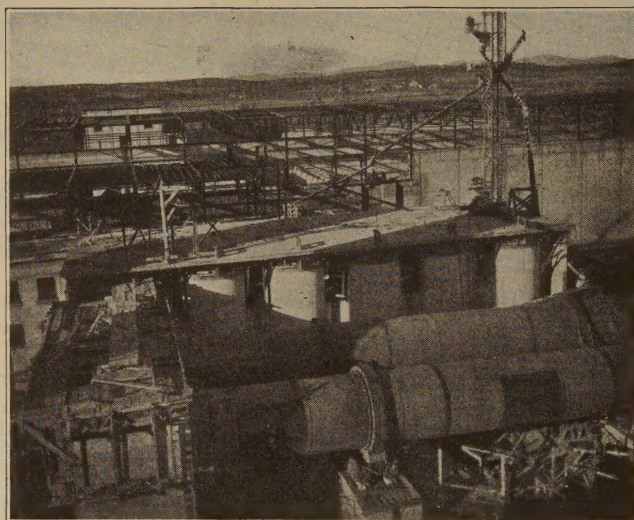
Grinding Department

There are four Allis-Chalmers No. 8740 compeb mills, each 8 feet by 7 feet by 40 feet in size. Two of these are used for raw grinding and two for clinker.

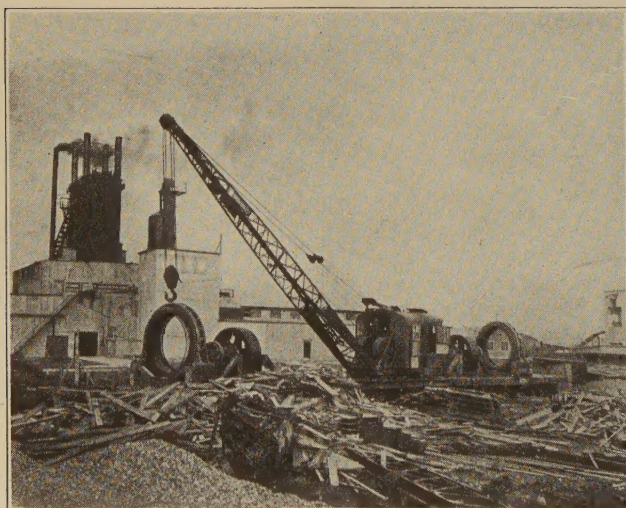
The mills are of the three-compartment type, having an external screen between the ball- and the tube-mill sections. The screen is so arranged that by changing the mesh, the relative amounts of work done by the ball- and tube-mill sections can be varied so as to secure the greatest overall efficiency.

The mills are driven by four 800-h.p. motors, running at 180 r.p.m. and operated by 2200-volt, 3-phase, 60-cycle current. This current is used on all large motors in the plant.

These motors, made by the Allis-Chalmers Company, are a comparatively recent development and are known as Hy-Tork motors. They represent the first American development of an idea known and used in Europe for some time. They resemble slip ring motors, but instead of having three slip rings, they have five. The motors start as slip ring motors by a gradual cutting out of resistance in the motor circuit. When nearly up to synchronous



View taken during installation of the kilns. The slurry tanks are seen in the background



Installing the mill motors

speed, direct current at 45 volts is introduced into the rotor circuit through the slip rings, giving in effect, a revolving magnetic field like that of the older style synchronous motors. The Hy-Tork motor then pulls into step with the supply current and operates as a synchronous motor. The entire operation is automatic, being controlled by two push-buttons, one for starting and one for stopping. These motors are well adapted for tube-mill operation because of the great torque needed in starting.

Correction Tanks

Sufficient water is added at the grinding mills to give the slurry a water content of approximately 33 per cent. The mills discharge into a trough containing a ribbon agitator. Slurry is pumped from the trough by Wilfley pumps and delivered to any one of the twelve correction tanks. Each correction tank is 16 feet in diameter, 26 feet high and equipped with a high speed agitator made by the Hill Clutch Machine and Foundry Company. The tanks are fitted with compressed air pipes for use as



Another view taken during installation of the kilns and showing the coal house in the background. The silos are seen at the right

emergency agitators.

One of the twelve tanks will be reserved for a slurry made of limestone only and one for pure clay slurry, so as to be available for correcting the mix as required.

All the tanks are interconnected in such a manner that the contents of two or more tanks can be mixed in any proportion desired. Pure limestone or pure clay slurry can be pumped into any tank so that the contents of every tank can be brought to the correct composition. Wilfley pumps are used to transfer the slurry from tank to tank for correction.

Kilns

Another Wilfley pump carries the corrected slurry to a large oval slurry storage basin under the kilns. This tank is fitted with a double Minogue agitator. Other Wilfley pumps convey the slurry from this tank to the Allis-Chalmers Ferris wheel feeders which drop it directly into the kilns. The slurry feeders are driven from the kiln drive mechanism by means of a single wrap of wire rope so that the speeds of the kilns and feeders are always proportional.

The two kilns are of Allis-Chalmers manufacture, 11 feet in diameter and 200 feet long, lined with high alumina brick in the burning zone.

The kilns are supported at four points, using continuously lubricated, water-cooled, bearings. They are driven by direct-coupled motors. All gears, with the exception of the girth gear and its pinion are completely housed in dust-tight cases and operated in oil.

The coolers are also of Allis-Chalmers make, 10 feet in diameter and 90 feet long. They are located directly under the kilns so that the clinker drops directly from the kiln to the cooler through a brick-lined chamber, insulated with Sil-O-Cel. The chute feeding the clinker into the cooler is of specially heat-resisting alloy. The coolers are lined, for a part of their length, with abrasive brick.

Handling Clinker

Provisions are made for handling the clinker direct from the kilns, if for any reason the coolers should be shut down. In normal operation, the clinker falls from the ends of the coolers into a heavy drag chain conveyor made by the Bethlehem Foundry and Machine Company, which takes it through a tunnel to an elevator from which it is discharged into storage.

The foot shafts and bearings of this elevator are of Bethlehem Foundry and Machine Company special design, having the bearings lined with manganese steel and the shafts protected with manganese steel sleeves. All elevator chains are extra heavy. They and the buckets were supplied by the Link-Belt Company. Sprocket wheels and other chains were supplied by the Chain Belt Company.

The 100-foot crane, operating in the main storage building, distributes the clinker into storage and also deposits it in a hopper over a Schaffer poidometer. The same crane also takes gypsum from storage and places it in another hopper over a smaller poidometer. These two poidometers are electrically interlocked so that neither can be operated without the other and so that both will stop if the feed to either one fails.

The poidometers discharge together into an elevator feeding a drag chain which distributes the mixture of clinker and gypsum into the feed hoppers of the two dry grinding finish mills. These mills, except for differences due to the character of the material ground, are of the same design as those used for raw grinding.

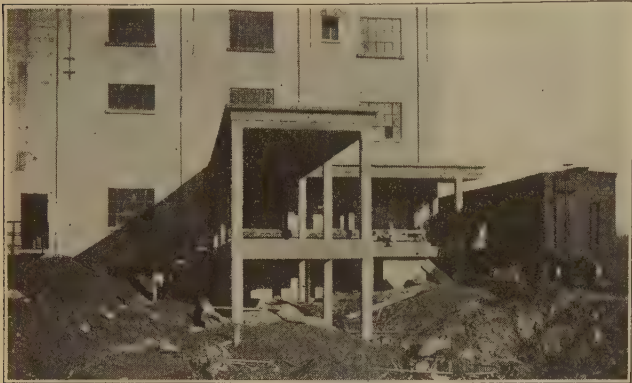
Finished Cement

The finish mills discharge into a conveyor feeding a small rotary screen. The cement passing this screen goes to one of two 8-inch Fuller-Kinyon pumps for transport through a 5-inch pipe, about 600 feet long, to the storage silos.

The storage silos are of 175,000 barrels capacity, arranged as shown on the plant diagram. The packhouse is equipped with four Bates packers, with provisions for both rail and truck loading.

Coal Department

Coal is unloaded from schooners at the Maine Central dock by a 25-ton gasoline operated Brownhoist locomotive crane owned by the cement company. It is loaded into hopper bottom cars which are switched to the plant. Here they may be dumped from an elevator trestle for



The truck loading platform. The company will take advantage of the national highway almost passing its door and will make truck deliveries to some extent

outside storage or dumped into a track hopper at the coal mill.

A Pennsylvania single roll crusher has been installed for use in case it is necessary to receive run-of-mine coal. The coal is elevated into a reinforced concrete bin over a Schaffer poidometer which feeds it into a Ruggles-Coles class A-12 dryer, fired with powdered coal. It is ground in Raymond mills with air separators. The separators are placed directly over the powdered coal bins feeding the burners at the kilns.

There is no separate conveying system for powdered coal except a short distributing screw over the kiln bins.



The motor and switchboard room, containing four 800-h.p. units that operate the grinding mills, is seen at the right

Coal is fed to the kilns by Bailey feeders, driven by adjustable speed, direct current motors. Air for blowing is supplied by Sturtevant fans. A similar arrangement, on a smaller scale, provides fuel for the coal dryer furnace.

Power for operating the mill will be purchased from



View during the construction of the change house

At the right the machine shop, and in the left foreground, the change house, which has numerous conveniences for the workers' welfare





Showing the incline from the quarry to the stone storage. The clay storage is seen in the background

the Maine Central Power Company and distributed through the company's own switchboard. The switchboard is located in a special room which contains also the four 800 h.p. Hy-Tork motors that operate the grinding mills, two 50 k.w. 125 volt synchronous motor generator sets and two Sullivan angle compound air compressors, each of 1800 cubic feet per minute displacement, direct connected to 300 h.p. synchronous motors. This room also houses a 6-cylinder, 360 h.p. Fairbanks-Morse Diesel engine, direct connected to a 240 k.w. generator. The principal use of this engine is to furnish power on short notice for keeping the agitators and other essential apparatus in operation in case of failure of the purchased power which comes to the mill over a line about 60 miles along.

The mill is quite isolated so far as access to a commer-

completely equipped with toilets, shower baths, and an elevated basket system for the workingmen's clothes and a fine reinforced concrete office and laboratory building.

Personnel

The officers of the Lawrence Portland Cement Company in close touch with the building of the new mill are Frank H. Smith, president; Chas. A. Porter, second vice-president; J. S. Van Middlesworth, secretary, and J. H. Van Middlesworth, purchasing agent. Mr. Porter was in active charge of the work, having spent practically all his time at Thomaston. Actual design was carried out by engineers of the Burrell Engineering and Construction Company, with A. C. Brunner in charge. The Lawrence crew organized its own construction organization and carried on the work by force account. E. J. Davis is superintendent and C. H. Sonntag was consulting engineer for the Lawrence Company.

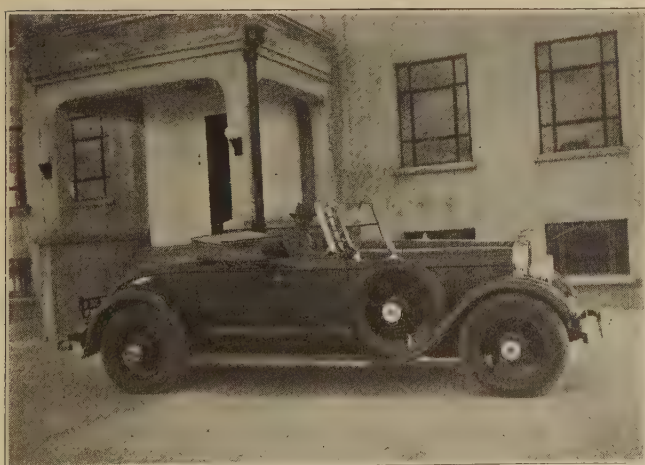
Kansas City Bureau Makes Report on 1927 Cement Shipped in Missouri

According to the Kansas City Cement Bureau, serving western Missouri, Nebraska, Kansas, Arkansas, Oklahoma and the Texas Panhandle, the mills reporting to it shipped approximately 9,000,000 barrels of portland cement into the territory in 1927, as compared with approximately 9,760,000 barrels into same (including all of Missouri) in 1926.

At the close of the year 1927 these mills had approximately 2,000,000 barrels of finished cement on hand.

Of the total shipments into the bureau territory in 1927, approximately 3,000,000 barrels were furnished for contract work, the balance to dealers for the general retail trade; and the close of the year the unshipped balance on contract commitments was substantially less than the amount carried over from 1926 commitments.

The total production of the mills reporting to the bureau, for 1927, was less than the previous years, reflecting the rather large carry-over from 1926 as well as the irregular demand through the earlier part of 1927.



Chas. Porter, second vice-president, shown at the office entrance

cial machine shop is concerned. For this reason an exceptionally well equipped machine shop has been provided, capable of taking care of any repair that is likely to be necessary.

Other buildings at the plant consist of a change house

Work on Seattle Plant Begins

Preliminary Details of the New Plant of the Pacific Coast Cement Company — Will Have Capacity of 1,200,000 Barrels Annually

WORK has started on the new cement plant of the Pacific Coast Cement Company. The steamship "Mazama" has been chartered and has left for Dall Island, Alaska, carrying materials for the wharf and living quarters and machinery for opening the quarry from which limestone will be shipped to the plant at Seattle.

The cement plant itself will be located on tidewater in Seattle, facilitating the receipt of the raw materials and permitting the shipping of cement by water. The plant is so located that it will be accessible to boats, all railroads entering Seattle and to trucks over paved highways.

Initial construction of the plant will provide for a capacity of about 1,200,000 barrels per year. It is laid out for four kilns, but provisions are made for the accommodation of two more kilns and the necessary additional equipment for later expansion.

Raw Materials

Limestone will be quarried on Dall Island, southeast Alaska, where a wharf is being built, and power house, living quarters, warehouse and crushing plant are being constructed.

The rock will be loaded by a Bucyrus 50-B two-yard electric shovel, with Ward-Leonard control. Primary crushing to 4½ inches will be carried on in a 42 by 48-inch Traylor steel frame jaw crusher; secondary reduction will be in a Dixie hammermill. Rock will be reduced to one inch minus in the crushing plant and will go into a storage pile, from which it will be taken by a 36-inch belt conveyor which will load the rock on the ships at the rate of about 600 tons per hour. All machinery in the crushing plant will be driven by electric motors with ball or roller bearings. The power plant will include two 360 h.p. engines direct connected to 3 phase 2200 volt generators. There will be provided in the power house also motor driven air compressors and pumps for water supply and fire protection.

A wireless station will be maintained at the quarry.

The crushed rock will be moved to Seattle in steel ships carrying cargoes of about 6300 tons. It is expected that the round trip will be made in eight to ten days.

Unloading will be done by a specially designed traveling hammerhead crane carrying a four-yard bucket. In the absence of the ship the crane will distribute the rock to storage and will also supply the raw mills directly from the cargo dump, eliminating a second handling on a large part of the rock used. The ships are owned and operated by the Pacific Coast S. S. Co., a subsidiary of the Pacific Coast Company.

Clay will be taken from a deposit along the Duwamish Waterway, and will be converted to a slurry at the clay plant. The slurry will be pumped into barges and towed to the cement mill where it will be pumped into two clay slurry tanks 36 feet inside diameter and 29 feet high.

Both the raw grinding and finishing mills are 7- by 45-foot, 3-compartment mills driven by 800 h.p. super-synchronous motors. The mills are to be furnished by the Traylor Engineering & Manufacturing Company and the super-synchronous motors by the General Electric Company.

The rock feed bins ahead of the raw mills will hold about a nine-hour supply of rock for the mill. The rock will be fed to the mill by weighing devices and clay slurry will be supplied to the mill through measuring devices, so that the output of the mill will be under close control as to analysis. One of the three mills installed may be used as either a raw or finishing mill.

Four large cement slurry tanks are provided. They are 36 feet inside diameter and 29 feet deep. Provisions will be made for pumping slurry from raw mills to slurry tanks, from tank to tank for correcting purposes, and from any tank in the slurry department to a 40-foot tank under the kilns, from which the kilns are supplied.

Kilns

There will be two kilns 11 feet 3 inches internal diameter by 250 feet long, each carried on four riding rings. The riding rings will be carried on so-called single-roll supports, that is, two rollers carried on the base rather than four rollers in two cradles.

Each kiln will be driven by a variable speed motor through a train of cut gears carried on roller bearings in an oil-tight case.

Slurry will be fed to the kilns by ferris-wheel type of slurry feeders whose controls are interlocked with the control of the kilns to prevent flooding of the kiln in case it is shut down.

Coolers, 9 feet in diameter by 90 feet long, will be placed under the kilns. These coolers will be provided with metal linings and numerous lifters and will have provisions for external cooling by air currents.

Storage

A large clinker storage area is roofed over and is to be served by a 6½-ton crane carrying a 2½-yard bucket. This crane will be able to feed clinker and gypsum to the finishing mills, and limestone to the raw mills.

Powdered coal, produced in Raymond high-side mills, will be burned in the kilns. Preliminary drying will be done in a McGann dryer 80 inches in diameter by 40 feet long, and final drying in the coal mills. Coal will be received in buckwheat size and very wet, because it comes from coal washing plants.

It is expected that finished cement will be moved from the mills to storage silos by Fuller-Kinyon pumps and will be withdrawn from the silos by means of screw conveyors and delivered to the sacking machines by screw conveyors and elevators. Provisions will be made for loading on railroad cars and also on trucks for local deliveries.

Every possible provision will be made to prevent the escape of dust from any piece of equipment, and dust collecting systems will be installed. The latest electrical precipitating equipment for the recovery of dust will be provided. Provision will be made for the installation of waste heat boilers whenever the market for steam might justify that.

A brick-lined concrete stack, 10 feet in diameter by 200 feet high, will be provided.

The design and construction of the plant is in the hands of the staff of the Pacific Coast Cement Company.

The Color of Cement

A Discussion of Some Factors Affecting the Color of Cement—Iron Content—Oxidation of the Clinker—Cooling the Clinker—Extent of Calcination—Fineness of Grinding—Foreign Matter—Admixtures—Conclusions

By MARC ELBER

IT was not so long ago that the author knew a sales manager who, before making a shipment of cement, would consult the laboratory for a record of strength values and leave, unconvinced, to examine samples from different silos and to consult the packing room foreman. The latter, with a gravity becoming a Chinese priest, would dispel his doubts by pointing to a handful of dust and saying: "Sure! it is sufficiently black!"

This prejudice is still strong on many building jobs, the only practical test of the quality of cement being its color.

So deeply rooted is this practice, that five or six years ago, a plant producing a yellowish cement due to the nature of the raw materials and the fuel used, appealed to the author for a method of correcting the deplorable reputation its product had won due to its color and was greatly relieved when a darker color was achieved by grinding a small quantity of iron with the clinker. Its reputation was re-established. The author, then a new man at the plant, heard many flattering reports and derived no little amusement from this incident.

This belief can be based on nothing else but an association of the respective colors of lime and portland cement and of their properties. Portland cement, being by far the more active material, its dark color soon became an indication of such activity in the eyes of laymen. Below will be shown how erroneous may be such generalizations.

Factors Affecting Color of Cement

The main factors affecting the color of portland cement may be classified in two groups:

1. Chemical factors.
 - (a) Iron content.
 - (b) Extent of oxidation of the clinker.
 - (c) Extent of calcination.
2. Physical factors.
 - (d) Fineness of grinding.
 - (e) Presence of foreign matter in the raw mix.
 - (f) Foreign admixtures ground with the clinker.

It is with intent that the author does not include the chemical composition of the clinker in the list, as such variations as are encountered in the respective proportions of SiO_2 , Al_2O_3 and CaO , i. e., in the hydraulic and silicic moduli, remain without appreciable effect on the color of cement. Even the presence of considerable quantities of dicalcium silicate in the clinker has little effect in this connection.

The product of spontaneous pulverizing of highly siliceous clinkers, cooled slowly, generally has a light color and presents a remarkable variation in shades. During grinding, these clinkers acquire the usual cement color, for they are not composed entirely of dicalcium silicate, as some would be led to believe. Each particle of clinker

is constituted by a core of standard clinker enveloped by a coating of dicalcium silicate γ . Even when the proportion of the latter inert constituent is very high, the final product shows no peculiarity of color.

(a) Iron Content

It is an incontestable fact that the color of cement is due to its iron content. In fact, white cements are none other but portland cements of standard chemical composition, whose iron content is very low, and which are calcined in a gas-fired kiln or some other method protecting them from contamination by impurities of the fuel. White cement is somewhat colored, as it is impossible to find materials entirely devoid of iron suitable for industrial uses. The calcium silicates, aluminates and silico-aluminates, prepared in the laboratory from pure silica, alumina and lime, however, are white, particularly when pulverized.

This being established, it stands to reason that—all other things being equal—the higher the iron content of a cement, the darker will be its color. This coloring due to the iron is the basis of the greenish black color of the standard clinker and cement. The gradation of black to green depends entirely on the quantity of iron present.

The quality of cement is not affected by its iron content within the limits specified by the standards.

(b) Extent of Oxidation of the Clinker

The coloring effect of iron and its derivatives on compounds of which they are a part is well known. Familiar also is the wide range of colors which may be imparted, when but a trace of iron is present.

Iron, which has been termed the mineral rainbow, may produce the entire range of colors from light yellow to red and dark brown, may be white as ferrous hydroxide, black as ferrous sulfide, green as ferrous sulfate, violet as ferric alum, may be in the form of Prussian blue or as red ferric sulfocyanate. Finally, it may be present as oxalates, whose colors have long puzzled the chemists. This "rainbow" is responsible for the color variations of marbles in 99 per cent of the cases.

The coloring effect depends on the nature of ions more or less complex which are formed by the iron in the various compounds. Again, each ion is transformed when the extent of oxidation is changed. These complex phenomena cannot be even summarized here, but the following may be stated:

The dark green color of standard clinker is met with only in a product calcined in a slightly oxidizing atmosphere. Lack of oxygen causes the color to approach grey, but never yellow nor red.

According to Kuhl (*Zement*, No. 26, July 1, 1926) the reduction of clinker is accompanied by considerable changes of constitution, yet it is not the cause of yellow or red color in the clinker. The latter would be due to

*Translated from *Revue des Matériaux de Construction et de Travaux Publics*, February, 1928, by Margaret Aronnet Corbin.

the presence of free iron oxide. In the clinker, calcined at temperatures above 1400 deg. C., calcium ferrite is dissociated into iron oxide and free lime, which two compounds react to combine again only at lower temperatures during cooling. If cooling takes place rapidly, by immersion in water, the reaction cannot take place and the free iron oxide imparts to the clinker a yellow or red color, frequently erroneously attributed to lack of air.

If calcining in a reducing atmosphere is harmful to the clinker, this defect becomes manifest by a change of color to grey, yet this difference in color is little apparent in the pulverized product.

Laboratory experiments carried out by the author in a gas fired test kiln have confirmed these conclusions.

At all events, calcination in a reducing atmosphere is abnormal, and denotes faulty methods of manufacture which may lead to considerable reduction of the strength of cement.

(c) Extent of Calcination

It would be impossible to name the color of underburned clinker; it varies from light yellow to dark yellow, from reddish yellow to a chocolate color, justly apprehended by the manufacturer.

It goes without saying that considerable quantities of underburned clinker, which at best has the value of hydraulic lime, mixed with normally calcined clinker, greatly reduce the strength of cement. Overburned clinker shows the same effect as to color, though to a lesser degree. It is compact, very hard, vitreous and has a brownish color. When ground, it yields a cement of a light yellow-brown color, whose strength is either equal or slightly inferior to that of a normally calcined product.

The incident referred to at the beginning of this article took place in a plant making cement from blast furnace slag. The materials used were slag with very high iron and alumina content, a fault corrected by admixtures of siliceous sand, kept at a minimum, as they involved increased consumption of limestone, whose quarrying and transportation was costly. The raw mix showed a point of fusion very close to the point of softening of the mass. Calcination proceeded in a rotary kiln with 20 to 23 per cent pulverized coal, which furnished in itself most of the fluxing material.

Under these conditions, it was impossible to maintain a narrow range of normal clinkerization; the clinker was overburned to avoid underburned or improperly burned clinker. Yet the cement yielded compressive strengths of 450 to 500 kg. at 28 days, although in its natural state it had a yellowish color, which, in the opinion of the consumers, denoted undesirable properties.

The greatest disadvantage of overburned clinker does not affect the consumer as much as the manufacturer: it is very hard to grind.

(d) Effect of Fineness of Grinding

A coarsely ground cement retains to some extent the dark green color of the clinker; increasing fineness causes this color to become lighter and approach grey. The activity of cement is known to increase with increasing fineness; thus dark color would not be a favorable indication.

(e) Foreign Matter in the Raw Mix

Few impurities have any effect on the color of cement; the most frequent of these is manganese oxide encountered in considerable quantities in raw mixes based on blast furnace slag.

Manganese oxide, when present in the clinker in amounts less than 2 per cent MnO_2 , has no effect on the quality of cement; it imparts to the latter a brown color, which is the more pronounced the higher the manganese oxide content. It is only when manganese oxide is present in quantities hardly ever dealt with in practice, that it has a detrimental effect on the setting and hardening of cement.

The change of color becomes manifest long before the effect on the setting and hardening properties becomes apparent.

(f) Foreign Admixtures Ground with the Clinker

All that can be stated in this connection may be found in M. Feret's remarkable treatise: *Additions des matieres pulverulentes aux liants hydrauliques* (Pulverized Admixtures in Cements), Rev. d. Mat. de Constr., publishers.

Admixtures generally accepted by cement manufacturers aim to improve or correct the product; other admixtures are but adulterants used to increase the weight or "dilute" the product by one of inferior quality.

In general, judiciously added admixtures improve the cement; this is the case with gypsum used to regulate the time of set and added in amounts not exceeding 5 per cent. It produces considerable increase in strength in most cases.

The same is true of admixtures of trass and puzzolan or even slag. The proportions may approach 1:1 without detrimental effects. Even inert material, such as limestone or silica sand, when pulverized with the cement, may improve its quality, if added in amounts not over 10 per cent.

It is obvious that cements receiving such admixtures will undergo corresponding changes of color. As the color of the admixture is subject to great variation, the color of the product cannot be accepted as a criterion.

Admixtures of infinitesimal quantities of carbon produce a dark color without affecting the strength of the product.

From the foregoing, it is clear that among all causes which produce a light color in cement, only one is to be feared—insufficient calcination—as it results in reduced strength.

In all other cases, color cannot be taken as criterion and a change to light color may prove favorable when produced by increased fineness.

When foreign admixtures are added to the clinker, utmost care is to be taken in drawing conclusions from the appearance of the cement.

A magistrate once said that the best proof of the guilt of the accused was the number and the excellence of his alibis. We can rest assured that underburned cement can find its way into the market only equipped with many alibis and armed with all the sales equipment required to disguise its natural defects.

Summary of United Foreign Trade

United foreign trade for the last three calendar years has been summarized in Special Cement Bulletin No. 2, Volume 3, compiled and issued by the Minerals Division of the Bureau of Foreign and Domestic Commerce, Department of Commerce.

Among the table headings are "Imports of Roman, Portland and Other Hydraulic Cement," "Exports of Portland Cement from the United States by Countries of Destination," and "Shipments of Cement to Non-Contiguous Territories of the United States."

The Development of the Alumina Cement Industry

Part III of the Study of Special Cements in Europe

By E. C. BLANC

In translating the present sections from "Le Ciment Portland," it has been necessary to select parts of the Blanc work, to omit others, and to fill in certain obvious gaps in the original discussion—all in order to give a fairly complete picture of the growth and status of the new industry. Such matters as raw material supplies, manufacturing methods and cost will be discussed in ample detail elsewhere, and can therefore be minimized here in order to keep this section down to a reasonable length.—Edwin C. Eckel.

Historical

WE group here, under the name of fused aluminous cements, the cements obtained industrially by igneous fusion of a mixture of proper raw materials, lime aluminates constituting the active elements of setting and hardening.

The hydraulic properties of the lime aluminates have been the subject of numerous studies, some of which date back many years. (As early as 1882 a book was published dealing exclusively with the subject of bauxite as a cement material, and in the same year the first processes were patented involving bauxite. In 1888 clinkered bauxite cements were described and patented, and in 1899-1902 fused-cement patents were secured. In 1906 Schott published the results of his extensive experiments, in the course of which he had actually made all the range of possible lime aluminates, and noted specially that certain of them gave far higher strengths than portland cement at very early periods.

We may say then that 22 years ago the problem was pretty well cleared up and that all the necessary data were available for further development of the new cements. What were still needed were (a) devising an economic process for manufacture of the alumina cements, (b) location of adequate raw material supplies and (c) an urgent technical reason for adoption of the new cements. These three requirements were met in the two decades which followed. Blanc takes up the story for the period 1908-1926. E. C. E.)

Among the more recent studies that may be specially noted, are the important contributions of Jules Bied in France and of H. S. Spackman and P. H. Bates in America. The researches of Spackman, commencing some 20 years ago, bore chiefly on the production of low-limed aluminates, corresponding to the proportions of two or three molecules of alumina to one of lime. Spackman discovered that the addition of such aluminates, even in very small percentages, to ordinary lime or to natural cement gave quick hardening mortars of high strength. In 1909 the Aluminate Cements Co. was formed for the

exploitation of the Spackman patents. Its object was the production of aluminates to be added to other cementing materials, and the raw material used was high alumina slag derived from the smelting of the iron ores of the Mayari region in Cuba.

Researches carried out at the same time, though from a different viewpoint, by Jules Bied in the laboratory of the Lafarge Company at Le Teil, France, ended in the production of mono-calcic aluminate cement, made by fusion of a mixture of bauxite and lime. This was patented in 1908 and placed on the open market in 1912 under the name of Ciment Fondu. Bied started from a statement by Vicat that a cement resistant to sulphate waters could be obtained if one could keep a hydraulic index superior to 1. Having already demonstrated that the low limed *silicates* had little hydraulic value, Bied attempted—successfully—to make a low-limed *aluminate* cement. In doing this he had no immediate thought of securing high early strengths. His object was to make a cement which would not be decomposed rapidly, as had all others, by the waters of the Mediterranean coast regions.

Commercial Development

During the war, the entire supply of Ciment Fondu was employed exclusively by the French army for purely military purposes. After the war, its commercial development was possible. Until 1919 the original Lafarge mill was the only one in the world which made an alumina cement of any sort. In 1919, however, Bied who had left the Lafarge company and joined the Bureau d'Organisation Economique, placed in operation an electric furnace mill at Luchon in the Pyrenees. In the following year another electric mill was built at Luzieres, as the result of experimental work by one of the steel companies. And also in 1920 the Lafarge Company built an electric mill at Moutiers in Savoie, in participation with an electro-chemical company. The B. O. E. mill at Luchon was dismantled later and finally in 1922 rebuilt at Bex in Switzerland. (All this activity with electric processes just after the war was a result of the temporarily high coke costs due to German damage; the electrics are very expensive and the product is not always good, like that of the coke furnace or the open-hearth. E. C. E.)

In 1923 the Atlas Aluminate Cement Co., later termed the Atlas Lumnite Cement Co., took up the manufacture of alumina cement in the rotary kiln in the United States; and in 1924 the Elektro-Zement-Gesellschaft built the last of the electrics at Zscharnewitz in Germany. The Lafarge Company, increasing its output heavily, built alumina cement mills at Baux Roux and at Vitry-le-Francois. And through subsidiary companies, or by participation with other companies, it began manufacture in England, in Indo China and in Italy.

(There is no country in the world where official or even semi-official statistics on alumina cement production are gathered and published; so that any estimate given here

is merely my personal guess. I should say that in 1927 the world output of alumina cement was probably around two million barrels. Since Blanc wrote the preceding section in 1926, at least three more countries have been added to the list of producers, and there were at least 16 mills operating in 1927. As a matter of comparison we may safely estimate that by the end of 1928 there will be twenty alumina cement mills in operation as against thirty to thirty-five mills making high strength portlands. As for company rank, Lafarge is still the largest producer, either directly or by its participations in other companies; Atlas ranks second; the B. O. E. group is still probably third, though not much ahead of a steel interest. From another viewpoint we can say that most of the existing alumina cement producers are also largely interested in portland cement. The company with the best known technical reputation—Vicat—is now making both alumina cement and high strength portland and apparently doing very well with both. On the other hand, the interests of electro-chemical companies are not increasing rapidly if at all. On the Continent, at least, steel interests are taking a hand, and this suggests the probable future trend of the new industry. E. C. E.)

Raw Materials

(The section on raw materials in *Le Ciment Portland* is not very complete and though the subject will be discussed in adequate detail elsewhere, I am inserting here the following data, to avoid leaving a gap in the present article. E. C. E.)

Relations of the Alumina-Iron Oxide Mineral Series

Composition	Anhydrous Minerals	Hydrated Minerals
Alumina essentially	A. Corundum	C. Bauxite, diaspoire
Chiefly Al_2O_3 , subordinate Fe oxides	A. Hercynite	C. Ferruginous bauxite
Al and Fe approaching equality	B. Emery	D. Laterite
Chiefly Fe oxides, Al_2O_3 subordinate	B. Aluminous magnetites	D. Aluminous limonites
Essentially iron oxides; Al_2O_3 accidental in gangue minerals	D. Magnetites and hematites	D. Limonite or Brown Iron Ores

The preceding table will clearly bring out certain points overlooked by the earlier makers and investigators of alumina cements, none of whom had more than a slight acquaintance with mineral raw materials in general.

The first point, which mere inspection of the table must make rather obvious, is that the bauxites are by no means the only possible sources of material for the alumina cement industry. There are obviously several series of other possibilities, all except corundum and diaspoire however, involving a necessary removal of superfluous iron oxide from the ore.

Separation of Iron

The second point, apt to be overlooked by cement chemists but not by iron metallurgists, is that though iron cannot be lessened or removed by the rotary kiln, it can be separated with ease by the electric, open-hearth, or blast furnace, so that the field of raw material choice is broadened enormously once we accept the furnace as the proper agent.

The third point, on which all metallurgists will agree, is that once we accept the furnace for melting the alumina cement charge, there are obvious technical and economic advantages in carrying a very high iron content and in recovering iron as a by-product of the cement operation. In small percentages, iron is a nuisance; in larger quanti-

ties it aids the process; in still larger quantities it affords a profit, up to the point where the recovered iron carries all the expense of the smelting.

What has been said here as to the wide variety of raw materials that can be used to make a good alumina cement at low cost must be limited to prevent possible misunderstanding. It is not possible to select a certain location and assume that any process and any raw material may be used there, with local fuel, to make a good and cheap product. The raw materials, fuels, plant and process are all inter-related, so that all these factors have to be considered with regard to any particular location, in order to secure maximum economy.

In the table above I have inserted the letters A, B, C and D to suggest, at least roughly, the relative abundance of the different ores named. Those marked A are scarce, and not worth considering as cement materials anywhere. Those marked B occur in large bodies at a few localities, and in such localities may become of service as cement materials. Those marked C are known to occur in large tonnages. Present known world reserves of these materials may be estimated in the hundreds of millions of tons. Finally, those marked D are very common. Present known world reserves are estimated in thousands of millions of tons. Looking toward the future, I should say that laterite will be the ordinary raw material for making alumina cement, particularly in the tropical and semi-tropical regions. It occurs in enormous tonnages, and is pretty near worthless for any other use. E. C. E.)

Manufacturing Methods

The raw materials are mixed without close control being necessary, since their proportions can vary quite widely without injuring the product. They can be fed to the furnace without preliminary treatment of any sort, though most mills crush and dry them, and some mills mix and briquette them. At others a preliminary roasting in separate furnaces is employed. (All these are merely devices used to overcome inefficient furnaces. None of these preliminaries are necessary in a properly built and operated mill. E. C. E.)

The fusion is effected at around 1425 deg. C. in a water-jacketed furnace, an open-hearth or an electric furnace. At Le Teil, where the water-jacket has been used since commencing operations, each furnace yields 15 to 25 tons of cement in 24 hours. Coke consumption is placed at 400 to 550 kg. per ton of cement. In the electric furnaces, which are of arc type, the consumption of current is from 1500 to 2500 k.w.h. per ton of cement. Adding the wear on the electrodes, which is severe, and we see that electric fusion is not sensibly more economic than the small water-jacket furnace.

The question of cooling is of the first importance in influencing the character of the product. Phenomena of crystallization and cooling of whose nature little is yet definitely known, are produced, which influence the character of the cement. Cooling practice is as yet in plain empiricism. Each producer works with the secrets of his cooling carefully guarded—the “secrets” consisting principally in the actual means employed for carrying out rapid cooling in a convenient fashion.

The fused mass is sieved and magnetically concentrated for removal of metallic iron; then ground in ball and tube mills. The milling is severe because of the hardness of the fused cement and because of the presence of metallic iron. Under these conditions tube mills use from 80 to 110 k.w.h. per ton, as against 25 to 35 k.w.h. for portland clinker. The wear on screens and other parts in contact with the ground cement is also much more severe with alumina than with portland cement.

EDITORIALS

Cement Quality Discussed

THERE was much of vital interest to the cement manufacturer and the cement chemist brought out at the American Concrete Institute convention, reported on other pages of this issue.

With the central idea of the convention revolving around the theme of better concrete, it was inevitable that the question of cement quality was definitely and openly discussed. The influence of the composition of cement on workability of concrete, on crazing, and on durability of concrete was not ignored when these subjects were under discussion.

The statement was made several times that different cements will vary widely in quality and performance. There seemed to be a general feeling in the meeting that the variation of cement—within the limitations set by the standard specifications—was a factor that could not be ignored in the attempt now being made to control the quality of concrete. That this was true from the standpoint of strength as an indication of quality, was brought out. In those other, new requirements of quality, such as durability, surface appearance, workability, etc., the question of cement as a variable was raised.

This critical questioning arises in spite of the fact that the concrete construction industry today has available what is probably the best and most uniform supply of cement that it has ever had. And since these critical questionings do arise in spite of that fact, it is important that cement manufacturers examine carefully the meaning of this attitude and its possible effects upon their own industry.

It does not seem that this attitude is the result of either propaganda or competition. The attitude is rather based on the need for quality control of concrete. Much has been learned of quality control, so much that most of the variables entering into the mix can be controlled within fairly narrow limits, one remaining important variable over which no increased control has been developed, being cement. Now, with the present diversification in portland cements, the problem becomes more difficult and more important. The exact prediction of concrete

performance is now more than ever dependent upon the cement itself.

Here is a part of what one speaker said: "All of us know that so far as the great cement-consuming public is concerned, cement is one brand or another of gray powder that comes in sacks. . . . We know, too, that recently we have been somewhat mixed up about this powder because certain makers tell us that their brand of powder is twice as good as another brand. . . . The practical minds of all of us cannot help inquiring about the value of this. Does it mean that we can strip our forms in one day instead of four? Does it mean that we shall have ten years of life in water exposure instead of five? Does it mean we can use half the quantity of cement?"

Such questions come naturally in the light of present conditions and they are put squarely to the cement manufacturer for an answer.

The man in the field will quite naturally want to use the best cement he can obtain economically. It is only to be expected that as rapidly as he learns about new cements of alleged superior quality, he will try them. And having tried them, he most naturally wants to take full advantage of every possible saving they may permit.

It is here that he runs into difficulties, for he has no definite standard of performance in excess of the standard specification which will enable him to measure the degree of superiority of one cement over another with assurance. His own experience may indicate a certain quality, but that is his only means of judging the product. He cannot tell from present methods of testing whether this quality is present or not. And so the experimenting with various brands goes on regardless of occasional unfortunate results to the individual operator.

The cement manufacturer has a responsibility to the user in these matters. Some means must be found to properly certify the performance of cements claimed to be above the average—or to prove conclusively that they are not so. It is only by establishing some means of measuring or predetermining the performance of these cements that this object can be secured.



MEN and MILLS

Notes from the Field

North American and Penn-Dixie Merger Reported

Latest Reports Deny International Corporation is Interested in Merger

Some credence is given to the report that the Pennsylvania-Dixie and the North American Cement Corporations are to be united as the result of a merger. The International Cement Corporation has denied all rumors that it will become a unit of the merger.

Terms were to have been announced late in March, but no other official acknowledgement of the truth of the rumor was made early in the month. It is believed the agreement would involve the exchange of two shares of North American common stock for one share of Penn-Dixie common, one and one-half shares of North American preferred for each share of Penn-Dixie preferred, and one North American bond for one share of Penn-Dixie preferred.

The North American was formed in 1925 by the merger of the Helderberg company with the Security Lime and Cement Company and the Acme Cement Corporation.

International owns eleven plants, including those in Argentine, Uruguay and Cuba, and Penn-Dixie has seven plants, all in eastern and southern states.

Ideal Makes Financial Report at Meeting

Contradictory to the first and advance report made in these columns in the March issue, of the Ideal Cement Company's meeting of stockholders, a financial statement was issued by the firm. A precedent was thus established.

Assets are listed at \$26,630,444.73; the liabilities and capital the same.

The net profit of the North American Cement Corporation in 1927 was reported to have been \$227,885, after deduction of charges, or \$4.42 a share earned on 51,500 shares of 7 per cent preferred stock. Net sales were \$5,916,073, against \$6,095,888. In a letter to stockholders President F. W. Kelley stated that gains in volume of business and reductions in unit costs during the past year were more than neutralized by sharp reductions in selling prices necessitated by foreign cement competition.

The Pennsylvania-Dixie Cement Corporation and subsidiaries report for 1927 a net profit of \$1,967,493 after depreciation, depletion, interest and federal taxes. This is equivalent to \$2.64 a share on 400,000 no par shares of common stock.

May Sell Michigan State Plant

The sale of the Michigan state cement plant at Chelsea will be recommended by Governor Green should a suggested special session of the legislature be called.

It is hoped to sell at a private sale if a good offer can be secured.

Canada Lowers Price to Raise Consumption

In the hope of stimulating consumption in western Canada, where it is reported to have been extremely low since before the war, the Canada Cement Company has reduced the price of cement twenty-five cents a barrel. The reduction is effective in all the Prairie provinces from Winnipeg west.

Monolith Midwest Plant Work Progressing

Installation of machinery is about to begin at the Laramie, Wyoming, plant of the Monolith Midwest Portland Cement Company. M. R. Roedere is in charge of construction work and will remain as superintendent. W. A. Gillette, representative of the financial department, has also taken up his residence there.

The plant will be operated on the customer-ownership plan. Shares of stock were placed on sale at Laramie and 2500 persons are now said to be shareholders.

Project of Texas State Plant Still Alive

A Texas state cement plant will materialize if desirable limestone deposits can be located. A resolution was adopted some time ago by the state legislature directing an investigation to ascertain the feasibility of such a plant and the state-wide aid of experimental stations has been promised to assist in the location of deposits.

The State Prison Board has expressed its sympathy with the purpose and has advised that the prison system would be interested if the plant could be operated by the system without a loss and with a reasonable income.

Capital Stock Increase Sought by Gulf Coast

The Gulf Coast Shell and Cement Company is seeking to increase its capital stock from \$10,000 to \$150,000. \$100,000 in stock is being offered to the public at par, \$10 per share. A main office has been opened at Houston, Texas.

Mud shell and gravel plants are located at Palacios, Matagorda county and at Collegeport. It is planned some time in the future to erect a portland cement plant on a 79 acre site near Tres Palacios bay.

Pyramid Properties to Be Sold

According to reports, the plant of the Pyramid Portland Cement Company at Valley Junction, Iowa, together with land and buildings and quarries, will be sold at foreclosure sale on March 31st. Value of the property is placed at \$2,000,000.

The plant has been in the receiver's hands since October 25th, 1927.

EARNINGS STATEMENT

Net earnings from operation after depreciation and federal income taxes.....	\$2,003,663.01
Miscellaneous earnings aside from cement manufacture.....	440,294.43
	\$2,443,957.44
Less special reserve for unadjusted federal income taxes and other contingent liabilities	200,000.00
	\$2,243,957.44
Less preferred stock dividends.....	576,898.00
	\$1,667,059.44
Balance of net earning available for surplus and common stock dividends.....	
Equivalent to \$8.33 per share on 200,056 shares of no par value common stock outstanding.	

Knickerbocker Gives Banquet for Department Heads

Its foremen and sub-foremen in departments with no 1927 lost-time accidents in the Hudson, New York, plant were the guests of the Knickerbocker Portland Cement Company at a banquet given at a local hotel on February 21st.

Talks chiefly on safety work were made by Thorkill Avensoe, general superintendent of the International Cement Corporation, D. P. Cooper, vice president and general manager, A. T. Ross, treasurer, and Claude Seipel, sales manager, all of the Knickerbocker Company.

It was disclosed that the entire plant had gone through 1927 without a lost time accident for nine months and all were urged to strive to make 1928 a perfect year.

Charles Andres, plant superintendent, Myron C. Swayze, and George Hickey were in charge of the evening.

California Cement Company to Blast Half of Mountain

A sizable blast will be made by the California Portland Cement Company when 150 tons of dynamite will break the rock formation of Mt. Slover, near Colton, California. No announcement will probably be made of the date, in order to avoid subjecting reckless spectators to danger.

Approximately half of the hill has already been used by the plant, but the forthcoming blast will be the largest in the history of the company.

American Contracts for Power Supply

The American Portland Cement Company has contracted with the Southwestern Gas and Electric Company for electric power for the operation of its cement plant at Foreman, Arkansas.

The new plant will have a connected load of approximately 4500 horsepower. The larger motors will be of the synchronous type. The operation of the plant will be so arranged that a high load factor may be obtained, enabling the company to obtain the minimum rate for electric current utilized. Under the proposed plan the estimated demand will be 2300 kilowatts with a load factor approximately 85 per cent 12 months in the year.

International Executive Dies

G. O. Curtis, International Cement Company executive and for twenty-eight years identified with the industry, died in New York City on March 5th. He had been ill three weeks.

Railroads File Briefs in Rate Controversy with Glens Falls

In the rate controversy now under way between Glen Falls Portland Cement Company, Lehigh district producers and the railroads, the latter, in presenting their claim before the Interstate Commerce Commission late in February, stated that they stand to lose \$600,000 revenue yearly if the Glens Falls Company is awarded the decision. Of this loss 65 per cent will be taken from the coffers of the New England roads, while the Delaware and Hudson will be the loser of the remainder.

The Glens Falls Company hopes to get a rate basis equivalent to that enjoyed by the Hudson, N. Y., district, some distance further south and closer to New York and Boston. The aim is opposed by the railroads on the ground that the Hudson district is enjoying, because of its natural location, a boom in the cement market.

Railroads Fight Proposed Reductions in Rates by Counter Demand

Demands made by cement manufacturers throughout the United States for lower freight rates were confronted, on March 7th, by a counter demand that the Interstate Commerce Commission refuse the proposed reductions because western lines alone have recently increased wages \$23,011,804 annually, while additional wage increases of \$32,000,000 per year for train and engine service employees alone are now the subject of negotiations.

The brief presenting the railroad's wage increases asked a broadening of the national investigation so as to include the entire cement rate scale and sets forth that the railroads cannot operate under the decreased rate.

Texas University to Study Soil

The Bureau of Economic Geology of the University of Texas will make a survey of Bell County, Texas. William Atkins of the University Geological Bureau will be in charge. A report will be made as to the possibility of manufacturing portland cement and similar products.

Veteran Former Coplay Employee Dies

John G. D. Bear of West Catasauqua, Pennsylvania, died there on February 25th. He had been employed by the Coplay Cement Manufacturing Company for more than thirty years prior to his retirement.

West Penn Plant Resumes Operation

Operations were resumed on February 27th at the plant of the West Penn Cement Company at West Winfield, Pennsylvania, following a shutdown since December 21st.

Pacific Reports Satisfactory Initial Year

The Pacific Portland Cement Company, at its annual meeting of stockholders on February 25th at San Francisco, California, announced that earnings of the company in the first year of reorganization, following its merger with Old Mission Portland, were satisfactory.

Net in the first nine months, ended December 31, was equal to \$2 a share of the common stock after preferred dividends, taxes, and so forth.

Feeder for New Cement Mill in Wyoming

The Laramie Valley Railway Company, backed by John A. Guthrie, vice president of the First National Bank of Laramie, Wyoming; Morris E. Corthell, a local attorney and A. W. McCullough, speaker of the house of representatives of Wyoming, will be built to haul limestone from the quarries to the new \$2,000,000 cement mill of the Monolith Midwest Portland Cement Company's mill at Laramie. The railroad will be twelve miles long.

Newaygo vs. Petoskey in a Basketball Game; Newaygo Wins

The Newaygo Portland Cement Company was the victor in a basketball game played at Newaygo, Michigan, with the Petoskey Portland Cement Company team on February 25th. The score was 31 to 17. H. Sherwood was the Newaygo forward.

Newaygo planned to go to Petoskey, Michigan, sometime during March for a return game.

Newaygo Holds Twelfth Annual Banquet

The twelfth annual banquet of Newaygo Portland Cement Company employees was held March 1st at Newaygo, Michigan. J. B. John, general manager of the plant, introduced Lyle E. Smith, superintendent of the Newaygo plant as toastmaster. H. G. Jacobsen addressed the gathering, emphasizing the value of safety first work.

Continuing its practice of giving gold watches to employees who have served twenty-five years, the company presented one to W. A. Osborn and another to Joseph Anderson.

Monolith Reports Prosperous 1927 at Stockholders Meeting

**Unable to Fill Orders for Products; Executives Make Reports
on Financial Progress Since First Year; Cite Advertising
as Source of Growing Demand**

Presenting a comprehensive, rapid-fire survey of production and marketing activities, showing steady growth and substantial profits, and outlining plans for further expansion to meet steadily increasing demand for its products, Coy Burnett, president of the Monolith Portland Cement Company, of Los Angeles, received the hearty support of the stockholders at their recent annual meeting.

After listening to a detailed description of the operations of the company, during which Mr. Burnett pointed out that highly satisfactory returns have been made, despite heavy expenses resulting from necessary marketing and production extensions and additions, the stockholders unanimously voted to re-elect all incumbent officers and directors.

Carroll A. Low, vice-president and general manager, presented a brief history of the activities of the company since the first barrel of Monolith cement was produced in its plant at Monolith, California, August 8, 1920, until the end of 1927.

Total shipments for 1920 were 58,664 barrels. Each succeeding year production and shipments increased rapidly, until at the end of 1927 a total of 1,445,794 barrels had been manufactured and shipped for the year. Each year, the manufacture and shipment of Monolith Plastic has also increased steadily, he said.

Mr. Low stated that at least 250 carloads more Monolith would have been shipped on orders during 1927, if the cement had been available; but the demand was greater than the production possible at that time.

Mr. Burnett explained that the Monolith plant is now being enlarged to increase production to take care of increasing demand. He said, "We have four times as many orders right now as we have had at the beginning of any previous year." Plant additions now under way at Monolith, he estimated, will cost \$350,000.

"Profits are said to be the measure of success of any concern," said Burnett. "I think there is a very fortunate exception to that rule, however. Unless they reflect or contemplate a substantial growth of a company, profits are a snare and delusion. I conceive it possible to make a showing of profits on the Monolith books that would tickle the fancy of the greatest imagination. But it is our duty to bear in mind that any company operated solely

to make profits in any one year would be the worst sort of an investment for any of us. It has been our policy from the beginning to keep in mind the betterment of our situation more than to work only for immediate profit. That has been instanced in a number of ways. We have spent more than \$500,000 in advertising. That comes out of our profits, yours and mine. If we were working solely for a profit showing we might eliminate the advertising; but that would inevitably react to reduce our profits through limited sale of our products. We may not benefit immediately from our advertising; for it is the accumulative effect of advertising that is valuable. But advertising is the factor that places us definitely in advance of any competitor. It is more valuable to all of us than any exclusive patents we have.

"Cement is an indispensable commodity today. We all use it and depend upon it, and with building really just commencing to grow large in volume throughout the United States, and particularly right here in southern California, we must continually expand our interests and enlarge our facilities if we are to keep pace with the steadily growing demand for our products which have become widely known through our advertising, and are now being extensively distributed throughout the Pacific coast region from Canada to Mexico."

In his financial report, Mr. Burnett pointed out that the Monolith properties are now more than five times as valuable by actual appraisal as they were seven years ago, due to constant development of deposits and improvements and equipment. He showed that cash dividends paid out amount to more than was originally paid into the company. He called attention to the fact that the dividends paid out carried no income tax charges, because the company had already paid those for the stockholders before dividends were distributed.

Reviewing profits, Burnett pointed out that after income tax deductions the average annual profit for the past five years exceeded \$500,000, and that after deducting annual expense on preferred stock, the balance still left shows earnings for common stock of approximately 34 per cent before depreciation and federal taxes.

He told of some of the difficulties of the past two years, when an influx of foreign cement, produced at an average labor cost

of 70 cents per day per man, created a temporary price war in local markets, and reduced profits in spite of the fact that more cement was produced and sold. He urged a protective tariff on cement to offset the vast difference between production costs here and in foreign countries due to great variance in labor standards. An 8 per cent dividend on common stock and the regular dividend on preferred at the rate of 8 per cent per annum was distributed.

Trinity Deeded Land for Clay Source

The Trinity Portland Cement Company has acquired recently 164.43 acres of land with frontage on the San Jacinto river north of Lynchburg, Texas. The acreage is divided into two tracts, one containing 125 acres and the other 39.43 acres. It will provide clay, delivered by barges, for use at the Houston plant, nearby.

The acreage was deeded to the Trinity Portland Cement Company by W. H. L. McCourtie, president, who purchased the land during 1927 from W. J. Howard, attorney.

Gilmore City Plant of North- Western States to Be Opened

The Northwestern States Portland Cement Company, Mason City, Iowa, on about April 1st will reopen its Gilmore City cement plant. The latter has been closed since its purchase two years ago.

Northwestern Starts Plant at Grotto, Washington

The Northwestern Portland Cement Company got its new plant at Grotto, Washington, into operation late in March. Orders at that time were on file for 300,000 barrels.

To Develop Cement Market in Honolulu

Captain A. Bullock Webster, special representative of the Monolith Portland Cement Company, is reported to be enroute to Honolulu. The purpose of his visit is to establish markets for the products from one or both of the company's plants. He will remain there several months.

Climatic conditions and the attacks of white ants (termites) are such as to call for building material which will withstand the ravages.

Heine Waste Heat Boilers at Weirton

Heine Boilers Are Installed to Utilize the Waste Gases from the Open Hearth Fur- naces at Weirton Steel Company

The engineers of the Weirton Steel Company were recently called upon to meet an increase in their steam load due to blast furnace and other plant extensions. There was some blast furnace gas available but not enough to furnish all of the heat required for steam making. There was an additional source of heat, however, in the hot gases going to waste up the open hearth stacks.

The engineers from several boiler manufacturers were called in. The Weirton engineers explained that the gas ducts leading from the open hearth furnaces to the stacks could not be moved. Neither could the stack. Neither could the operating floor be disturbed. The boilers must fit into a given floor space, and a given headroom in such a way that the existing stack and flue could be utilized. Furthermore, the units were to furnish superheated steam.

The engineers of the Heine Boiler Company made an inspection of the boiler site. This indicated that only some vertical type of boiler could be used. The gas temperatures required the superheater location to be in the gas duct just ahead of the boiler, and, the stack and fan location permitted only a top gas outlet. The recommendation of the Heine Boiler Company's engineers was a two drum, three bank, three pass bent tube boiler as shown in the illustration.

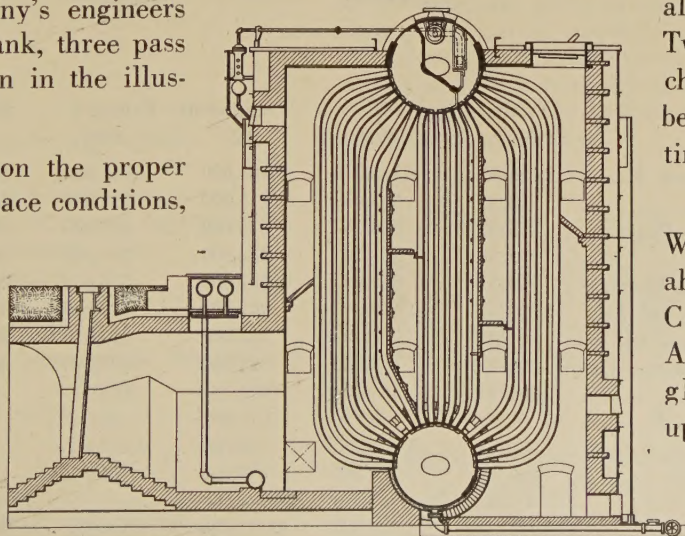
Having determined upon the proper type of boiler to fit the space conditions, the next step was to proportion the heating surface and gas passes to fit the gas quantities available to locate the baffles and design and locate the access and cleanout doors. Since a waste heat boiler ab-

sorbs heat by convection only, it was important that a uniform and high gas velocity be maintained throughout the boiler, and that all of the heating surface be swept by the hot gases. The boiler tubes were accordingly arranged in three banks of seven, six and five tubes located in the order given from the inlet toward the outlet of the boiler, and, the baffle arrangement shown in the illustration was employed.

The water was fed into the upper drum on the rear bank or exit gas side. A diaphragm was provided to divide the drum, causing a true counter flow of feed water and gas in the rear tube bank and at the same time adding two 180° turns to the steam liberated in the front and middle tube banks. This feature and the dry pipe purifier insured dry steam.

Air tight settings are even more important in waste heat boilers than in direct fired installations, due to the higher draft carried. An airtight steel casing was designed which could be erected in the field without riveting. Access and cleanout doors were provided with ground seats and faces and universally hinged so that the faces and seats would always be in true alignment. Two of these units were purchased in 1926. A third is being installed at the present time.

An interesting folder on Waste Heat Boilers is available. The Heine Boiler Company, 200 Madison Avenue, New York, will gladly send you a copy upon request.



Cement Statistics for February

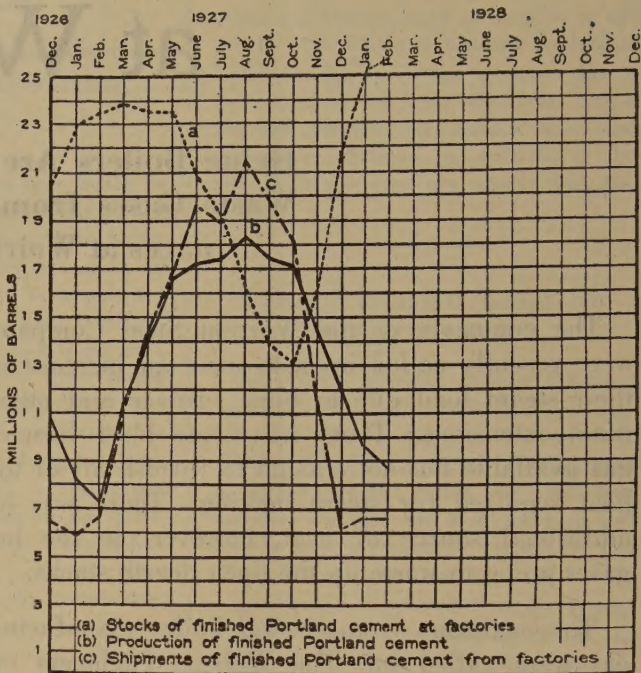
THE portland cement industry in February, 1928, produced 8,785,000 barrels, shipped 6,559,000 barrels from the mills, and had in stock at the end of the month 27,339,000 barrels, according to the United States Bureau of Mines, Department of Commerce. The production of portland cement in February, 1928, was 19 per cent greater, and shipments about 3 per cent less, than in February, 1927. Portland cement stocks at the mills were 16 per cent higher than a year ago.

The statistics here presented are compiled from reports for February from all manufacturing plants except two, for which estimates have been included in lieu of actual returns.

The output of finished cement by the 155 plants active during February, 1928, was equivalent to 47.5 per cent of the estimated capacity, as compared to an output of 44.6 per cent of capacity of the 141 plants active in February, 1927. Similar comparisons for other periods are given below:

Relation of Production to Capacity

	—February—		Jan.	Dec.	Nov.
	1928	1927	1928	1927	1927
	Per cent	Per cent	Per cent	Per cent	Per cent
The month	47.5	44.6	49.4	60.7	75.9
The 12 months ended	75.1	76.2	74.5	76.2	73.7



Production, Shipments and Stocks of Finished Portland Cement, by Months and by Districts, 1927 and 1928, and Stocks in January, 1928

	—Production—		—Shipments—		Stocks at end of month	
	1927	1928	1927	1928	1927	1928
January	8,258,000	*9,766,000	5,968,000	*6,540,000	22,914,000	*25,175,000
February	7,377,000	8,785,000	6,731,000	6,559,000	*23,563,000	27,339,000
March	*11,450,000		*11,100,000		23,922,000	
April	14,048,000		14,350,000		23,654,000	
May	16,701,000		16,865,000		23,503,000	
June	17,224,000		19,761,000		20,972,000	
July	17,408,000		18,984,000		19,397,000	
August	18,315,000		21,411,000		16,292,000	
September	17,505,000		19,828,000		13,996,000	
October	17,174,000		18,105,000		13,141,000	
November	14,449,000		11,619,000		*16,022,000	
December	11,999,000		6,200,000		21,821,000	
	171,908,000		170,922,000			

*Revised.

District	Production—February		Shipments—February		Stocks at end of February		Stocks at end of Jan., 1928*
	1927	1928	1927	1928	1927	1928	
Eastern Pennsylvania, New Jersey, Md.	2,353,000	2,135,000	1,708,000	1,455,000	5,761,000	6,566,000	5,886,000
New York	229,000	305,000	215,000	288,000	1,453,000	1,778,000	1,761,000
Ohio, Western Penn., and West Virginia	865,000	978,000	543,000	487,000	2,942,000	3,393,000	2,903,000
Michigan	263,000	291,000	334,000	316,000	2,019,000	2,194,000	2,218,000
Wisconsin, Illinois, Indiana, and Kentucky	450,000	901,000	652,000	578,000	3,239,000	3,732,000	3,409,000
Virginia, Tenn., Ala., Ga., Fla., and La.	1,020,000	1,037,000	992,000	922,000	1,197,000	1,967,000	1,851,000
Eastern Missouri, Iowa, Minn., and So. Dak.	404,000	747,000	362,000	319,000	3,241,000	3,955,000	3,527,000
Western Missouri, Nebraska, Kansas, Okla.	236,000	487,000	527,000	495,000	1,556,000	1,647,000	1,655,000
Texas	396,000	460,000	382,000	423,000	475,000	460,000	423,000
Colorado, Montana, and Utah	65,000	108,000	101,000	85,000	482,000	496,000	473,000
California	888,000	1,164,000	736,000	1,016,000	707,000	764,000	616,000
Oregon and Washington	208,000	172,000	179,000	175,000	491,000	387,000	391,000
	7,377,000	8,785,000	6,731,000	6,559,000	23,563,000	27,339,000	25,113,000

*Revised.